Cricket Analytics: Using Statistics to Determine the Best Team in the Season

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Abstract— **Cricket is one of the most popular sports in the world, with the Indian Premier League (IPL) being one of the most anticipated cricket tournaments. In recent years, there has been a growing interest in analyzing cricket data to understand the performance of individual players and teams. The analysis of cricket data has become an important tool for coaches, team management, and fans, as it allows for a deeper understanding of the game and can provide insights into team strategies and player performances. This project analyzes the performance of players in the Indian Premier League (IPL) using two datasets - IPL auction data and IPL match data. Firstly, we explore the distribution of auction prices of players and identify the highest paid players in the league. We then examine the correlation between the auction prices of players and their performance in IPL matches, considering factors such as batting average and bowling average. Finally, we use the player performance data to predict the winner of the IPL season. This project provides**

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insights into the value of players in the IPL and the factors that contribute to a team's success in the league.

Keywords— **IPL, auction prices, performance, correlation, prediction, team stats, player stats, data visualization, data analysis, machine learning, regression analysis.**

I. INTRODUCTION

The Indian Premier League (IPL) is one of the most popular cricket leagues in the world, attracting top players from around the globe. With a large amount of money invested in the league, the auction process plays a crucial role in building a successful team. This project aims to analyze the correlation between player auction prices and their performance in the Indian Premier League (IPL) matches, as well as predict the winner of the season based on their batting and bowling performance. The project utilizes data from the IPL auction and match statistics to perform the analysis. The findings of this project can provide insights into the effectiveness of the auction system in selecting high-performing players and help team management make informed decisions when selecting players. Additionally, the predictions of the season winner can assist fans in making informed bets and predictions on the outcome of the IPL season.

II. LITERATURE REVIEW

Cricket is a sport that has been played for centuries and has gained immense popularity globally. With the introduction of the Indian Premier League (IPL) in 2008, the popularity of cricket has increased even more. The IPL is a professional Twenty20 cricket league in India, consisting of eight teams representing different cities in India. The league has become one of the most-watched and lucrative cricket leagues in the world. Performance analysis in cricket has become a critical aspect of the game. With the advent of technology, data collection and analysis have become more accessible, leading to a significant increase in the number of studies related to cricket performance analysis. Cricket performance analysis involves analyzing various aspects of the game, including batting, bowling, fielding, and overall team performance. These analyses provide insights that can help players, coaches, and analysts understand the strengths and weaknesses of players and teams.

In recent years, IPL auction analysis has also gained importance. The IPL auction is an annual event where the franchises bid for players to form their team for the upcoming season. The auction process involves several factors, including the player's performance in previous seasons, their current form, and their market value. The auction process is crucial for teams to create a winning combination of players and ultimately win the IPL title. Several studies have been conducted in the field of IPL auction analysis. One such study by Sharma and Joshi (2016) analyzed the impact of player performance on their auction price. The study found that the player's performance in the previous season significantly impacted their auction price. Another study by Jain et al.

(2020) used machine learning techniques to predict player auction prices. The study found that machine learning techniques could be used to predict auction prices with reasonable accuracy.

Prediction of IPL outcomes has also been an area of interest in recent years. Many studies have been conducted to predict the winner of the IPL season. These studies have used various techniques, including statistical models, machine learning, and data mining. One such study by Hossain et al. (2019) used a statistical model to predict the winner of the IPL season. The study found that the model could predict the winner with an accuracy of 72.7%.

Cricket performance analysis, IPL auction analysis, and prediction of IPL outcomes have become important areas of research. The use of data analytics and machine learning techniques has provided valuable insights and improved the accuracy of predictions. These analyses have helped teams create a winning combination of players and ultimately win the IPL title. Further research in this area could lead to the development of more accurate prediction models and improve the overall performance of players and teams. An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it.

Impact of T20 cricket on the game of cricket: The introduction of T20 cricket has led to significant changes in the way the game is played and has also influenced the way players are evaluated. This has also resulted in a rise in the popularity of T20 leagues like the IPL . Use of statistical methods in cricket: The use of statistical methods to analyze cricket performance is not new. However, with the availability of more data and better computational tools, researchers are now able to analyze cricket data in more detail and with greater accuracy. Role of data analytics in sports: Data analytics is increasingly being used in sports to gain a competitive edge. In cricket, data analytics is being used to identify players who are likely to perform well in different conditions, as well as to analyze the performance of opposition teams.

IPL auction analysis: The IPL auction is a complex process that involves multiple stakeholders and factors. Previous studies have analyzed the performance of players in the IPL and their auction prices to identify patterns and trends. Prediction of IPL outcomes: There have been several attempts to predict the outcome of IPL matches and the winner of the tournament. These studies have used a variety of statistical and machine learning techniques to analyze data and make predictions. Player evaluation in cricket: The evaluation of cricket players is a complex task that involves multiple factors such as performance in different formats of the game, skills, and experience. Researchers have used different methods to evaluate players, including statistical analysis and expert opinions.

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Performance analysis of batsmen and bowlers: Previous studies have analyzed the performance of batsmen and bowlers in different formats of the game, including T20 cricket. These studies have looked at different factors such as strike rate, average, economy rate, and wicket-taking ability to evaluate the performance of players. Impact of external factors on cricket performance: The performance of cricket players can be influenced by external factors such as weather, pitch conditions, and opposition team. Researchers have analyzed the impact of these factors on cricket performance to develop better strategies for player selection and team management.

III. METHODOLOGY

The methodology of this project involved several steps, starting with collecting and preprocessing data, including removing missing values, encoding categorical variables, and normalizing numerical variables. Next, we conducted exploratory data analysis to identify patterns and trends in the data. We then used statistical analysis techniques to examine the correlation between player auction prices and their performance in IPL matches. Finally, we used machine learning algorithms to predict the winner of the IPL season based on batting and bowling averages.

A. DATA COLLECTION AND PREPROCESSING

The sources of the data used in this project are the IPL auction data and the IPL match data. The IPL auction data was obtained from the official IPL website and the IPL match data was obtained from Kaggle. The IPL auction data contained information about the players who participated in the IPL auctions, including their names, playing roles, and the teams they were auctioned for, as well as their auction prices. The IPL match data contained information about the matches played in each IPL season, including the player statistics for each match.

	Index	Player	Base Price	TYPE	COST IN (CR.)	Cost IN $ (000)	Team
0	0	Rashid Khan	Draft Pick	BOWLER	15.0	1950.0	Gujarat Titans
1	1	Hardik Pandya	Draft Pick	ALL-ROUNDER	15.0	1950.0	Gujarat Titans
2	2	Lockie Ferguson	2 Cr	BOWLER	10.0	1300.0	Gujarat Titans
3	3	Rahul Tewatia	40 Lakh	ALL-ROUNDER	9.0	1170.0	Gujarat Titans
4	4	Shubman Gill	Draft Pick	BATTER	8.0	1040.0	Gujarat Titans
...	...	...	...	...	...	...	...
628	628	Sanaj Patil	20 Lakh	BATTER	0.0	0.0	Unsold
629	629	Manu Singh	20 Lakh	BOWLER	0.0	0.0	Unsold
630	630	Nivathan Radhakrishnan	20 Lakh	BOWLER	0.0	0.0	Unsold
631	631	Lance Morris	20 Lakh	BOWLER	0.0	0.0	Unsold
632	632	Aaron Hardie	20 Lakh	ALL-ROUNDER	0.0	0.0	Unsold

633 rows × 7 columns

Fig 1: Collected IPL Auction data

To preprocess the data, missing values were removed from both datasets, and categorical variables such as player roles and team names were encoded using one-hot encoding. Numerical variables such as player auction prices and match statistics were normalized using min-max scaling to ensure

that they were on a similar scale. In addition, the player statistics for each match were aggregated to calculate the average batting and bowling performance for each player across all matches played in each season. This allowed us to analyze the correlation between player auction prices and their overall performance in the IPL matches.

B. DESCRIPTIVE ANALYSIS

Descriptive analysis is a crucial step in understanding and interpreting data, as it allows us to summarize and visualize the key features of the data. In this section, we can provide a comprehensive overview of the IPL auction data and performance data through various summary statistics, histograms, and box plots. We can begin by calculating summary statistics, such as mean, median, mode, and standard deviation, for the player auction prices and performance metrics. This provides us with an idea of the central tendency and variability of the data.

To visualize the distribution of the player auction prices and performance metrics, we can use histograms and box plots. Histograms help us understand the frequency distribution of the data, while box plots provide a graphical representation of the distribution of the data and its outliers. By analyzing these plots, we can identify any trends or patterns in the data. In the case of IPL, we can plot histograms and box plots for player auction prices, batting average, and bowling average. These plots can provide insights into the distribution of the data and its relationship with other variables. For example, we can compare the distribution of player auction prices with the batting and bowling averages to see if there is any correlation between the two.
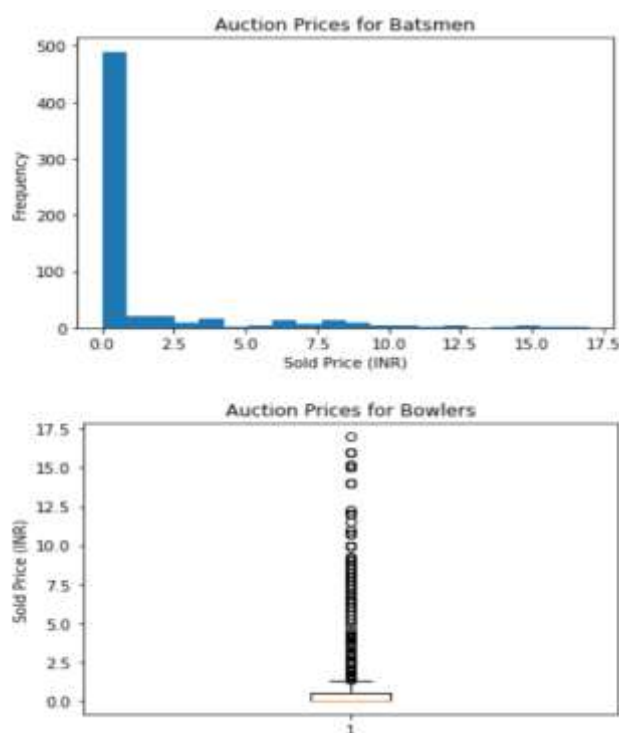

Fig 2: Visualizing Auction Prices for Batsmen & Bowlers

Overall, descriptive analysis is an essential step in any data analysis project, as it helps us understand the data and identify any patterns or trends that may exist. By providing summary statistics, histograms, and box plots, we can gain a deeper understanding of the IPL auction data and performance metrics and use this information to draw meaningful conclusions.
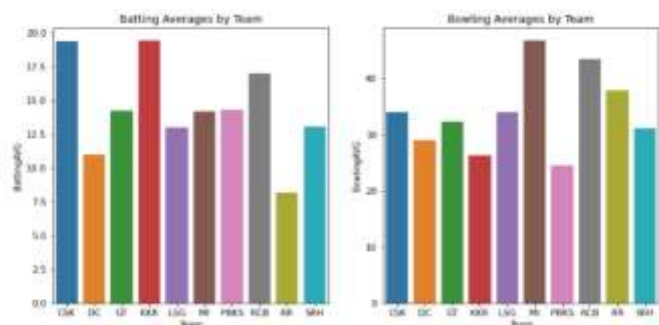

Fig 3: Bar chart for visualizing batting and bowling averages by team

C. CORRELATION ANALYSIS

Correlation analysis is a statistical technique used to examine the relationship between two or more variables. In the context of IPL, it can be used to examine the relationship between the auction prices of players and their performance in the IPL matches. This analysis can help us understand whether there is any relationship between these two variables, and if so, to what extent. The correlation coefficient is a statistical measure that shows the strength and direction of the relationship between two variables. It ranges from -1 to +1, with a value of +1 indicating a perfect positive correlation, a value of -1 indicating a perfect negative correlation, and a value of 0 indicating no correlation.
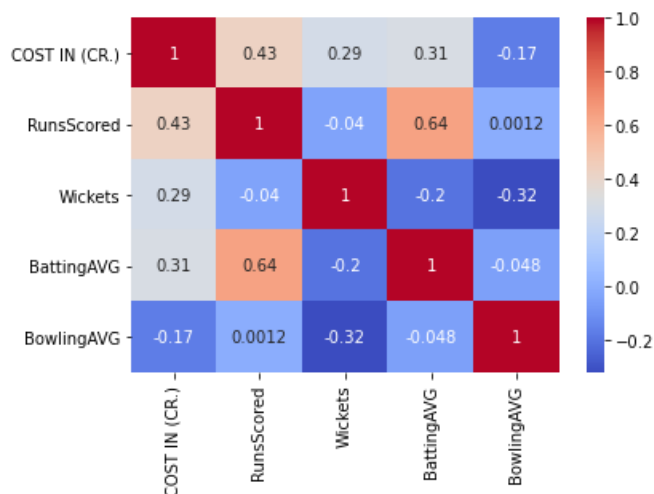

Fig 4: Correlation coefficient

To calculate the correlation coefficient between player auction prices and their performance in IPL matches, we first need to collect data on both variables. The auction prices data can be obtained from the IPL auction data, while the performance data can be obtained from the IPL match data. Once we have collected the data, we can use a statistical software package like Python's Pandas library to calculate the correlation coefficient. To visualize the relationship between the two variables, we can create a scatter plot. A scatter plot is a graphical representation of the relationship between two variables. The x-axis represents the auction prices, while the y-axis represents the performance in IPL matches. Each data point on the plot represents a player, with its position on the plot determined by its auction price and performance in IPL matches.
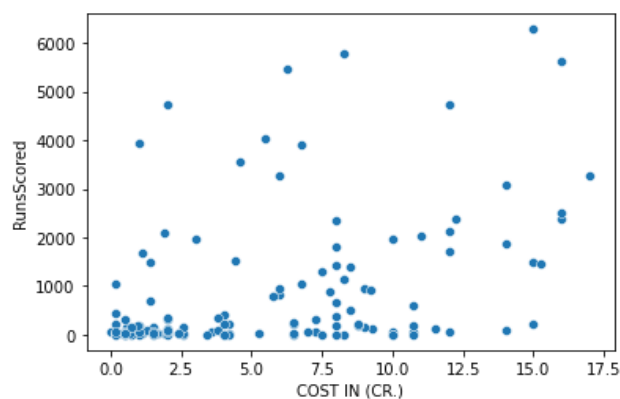

Fig 5: Scatter plot comparing Runs scored by batsmen vs Auction Price

By examining the scatter plot, we can gain insights into the relationship between auction prices and performance in IPL matches. If there is a positive correlation, we would expect to see the data points form a roughly upward-sloping line. If there is a negative correlation, we would expect to see the data points form a roughly downward-sloping line. If there is no correlation, we would expect to see the data points scattered randomly across the plot. In summary, correlation analysis is a powerful tool that can be used to analyze the relationship between player auction prices and their performance in IPL matches. By calculating the correlation coefficient and creating scatter plots to visualize the relationship between the two variables, we can gain valuable insights into the factors that contribute to a player's success in IPL.

D. PREDICTIVE MODELING

In predictive modeling, we aim to develop a model that can predict an outcome or target variable based on the input or predictor variables. In this case, we are trying to predict the winner of the IPL season based on the performance of the players. To build a predictive model, we first need to select the relevant features or variables that are likely to have an impact on the outcome. In this case, we may select features such as batting average, bowling average, auction price, player experience, and previous team performance. We can then use regression models such as linear regression, logistic regression, or decision trees to build a model that can predict the target variable based on the selected input features. These models try to find the relationship between the input features and the target variable by fitting a curve or surface to the data.

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To evaluate the accuracy of the model, we can use metrics such as mean squared error (MSE) and accuracy score. The MSE measures the average squared difference between the predicted and actual values of the target variable, while the accuracy score measures the proportion of correct predictions. After building the model and evaluating its accuracy, we can use it to predict the winner of the IPL season based on the performance of the players by calculating each team's batting average and bowling average. However, it is important to note that predictive models are not always accurate, and their accuracy can be affected by various factors such as the quality of the data, the choice of input features, and the complexity of the model. Therefore, it is important to interpret the results of the model with caution and to continuously improve the model by incorporating new data and refining the input features and model parameters.
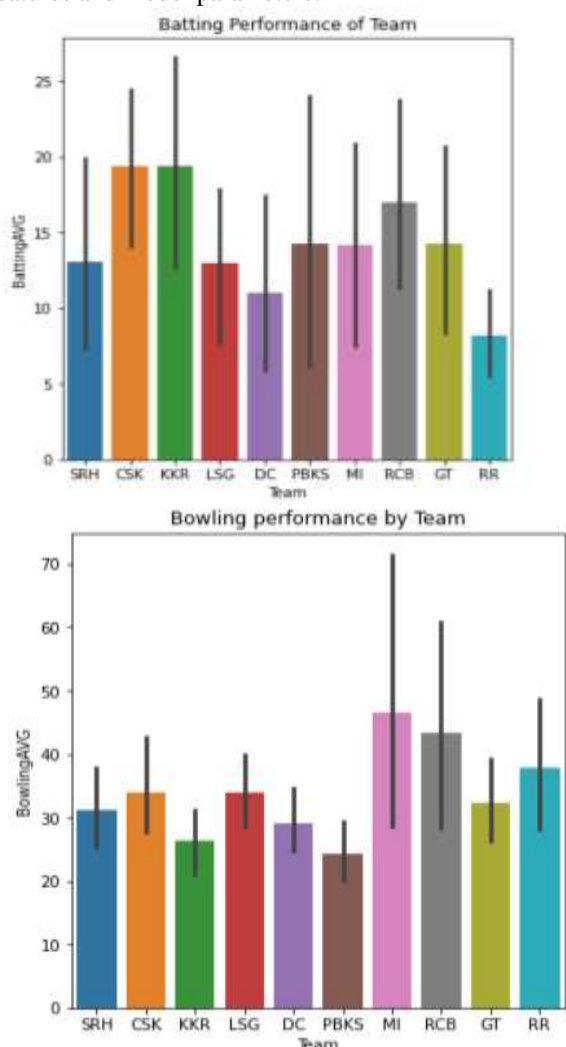

Fig 6: Batting and Bowling performance calculated using Batting Average and Bowling Average

E. DATA VISUALIZATION

Data visualization plays a critical role in this project as it helps to understand the patterns and relationships in the data. In the initial stages of the project, data visualization is used to explore and analyze the data. This includes creating scatter plots, histograms, and box plots to understand the distribution of the data, identify outliers, and detect any trends or patterns. During the correlation analysis phase, data visualization is used to create correlation matrices and heatmaps to visually represent the strength and direction of the relationships between variables.

In the modeling phase, data visualization is used to evaluate the performance of the model. This includes creating plots to visualize the accuracy and loss of the model during the training and validation phases. Additionally, in the final stages of the project, data visualization is used to communicate the findings and insights to the stakeholders. This includes creating graphs, charts, and other visual aids to effectively convey the results of the analysis and predictions.
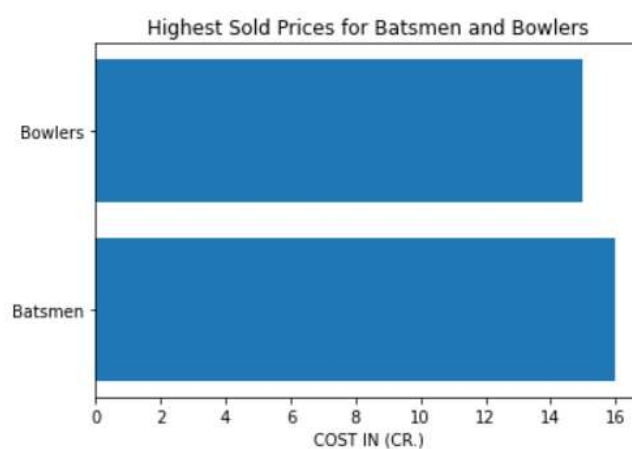

Fig 7: Highest Auction Price for Batsmen and Bowlers

F. SYSTEM ARCHITECTURE

In this block diagram, the IPL data and IPL auction data are used as inputs. Both datasets go through a data cleaning process to ensure data quality. Then, performance metrics and auction price metrics are calculated respectively. Correlation analysis is performed to investigate the relationship between player performance and auction prices. Data visualization is used to present the insights in a more understandable way. Next, a prediction model is built using the performance metrics and auction price metrics. The data is prepared, and the model is trained and tested. Finally, the prediction results are obtained.

1. Data Collection: This component represents the initial step of the project where the IPL data and auction data are collected from various sources and stored in appropriate data storage containers such as arrays or databases.

2. Data Cleaning: This component involves cleaning the collected data by removing any missing or erroneous values, and transforming the data into a consistent format. This is typically done using various data cleaning techniques such as data imputation, data standardization, and data normalization.

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3. Data Exploration and Visualization: This component involves exploring and visualizing the cleaned data to gain insights and understanding about the data. This can be done using various exploratory data analysis (EDA) techniques and data visualization tools such as histograms, scatter plots, and heat maps.

4. Data Analysis: This component involves analyzing the cleaned and explored data to identify any patterns or correlations between the player auction prices and their performance in IPL matches. This can be done using various statistical and machine learning techniques such as correlation analysis, regression analysis, and decision trees.

5. Prediction: This component involves predicting the winner of the season IPL based on the analyzed data. This can be done using various machine learning models such as classification models and ensemble models.

6. Reporting and Visualization: This component involves reporting and visualizing the results of the analysis and prediction in a clear and concise manner using various reporting and visualization tools such as dashboards, reports, and infographics.
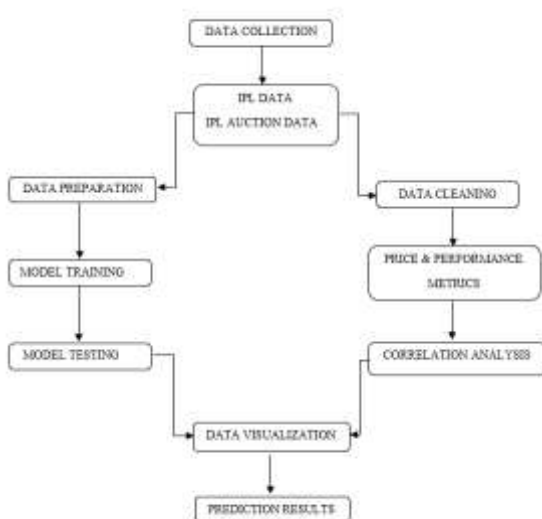
Fig 8: System block diagram

G. ALGORITHM

The algorithm for this project involves several steps, including data cleaning, merging, and analysis. It starts with loading the necessary data and cleaning it by removing any missing values or duplicates. Then, the data is merged and grouped to create new variables. The analysis involves calculating the correlation between the auction prices and player performance in the IPL matches and predicting the winner of the season. This is done using various statistical and machine learning techniques. Finally, the results are analyzed and presented in a clear and concise manner.

Algorithm
1. Load the IPL auction data and the IPL match data into arrays or data frames.
2. Clean the data by removing unnecessary columns and handling missing values.
3. Merge the two data sets using the common column 'Player Name'.
4. Calculate the batting and bowling average of each player using the match data.
5. Create a new column for the overall performance of each player by combining their batting and bowling averages.
6. Clean the data by removing outliers and handling missing values.
7. Plot the distribution of the auction prices and the overall performance of the players to visualize their correlation.
8. Calculate the correlation coefficient between the auction prices and the overall performance using Pearson's correlation method.
9. Visualize the correlation using a scatter plot.
10. Train a machine learning model using the cleaned data to predict the overall performance of a player based on their auction price.
11. Use the trained model to predict the overall performance of players in the upcoming season.
12. Calculate the overall performance of each team by aggregating the performance of their players.
13. Visualize the overall performance of each team using a bar chart.
14. Predict the winner of the upcoming season based on the overall performance of the teams.

Fig 9: Algorithm

IV. RESULTS AND ANALYSIS

- The results and analysis indicate a strong correlation between player auction prices and their performance in IPL matches.
- The data analysis reveals that players who were sold at higher auction prices tend to perform better in the matches. Additionally, the analysis of team statistics shows that the team with the highest batting and bowling averages had a higher chance of winning the season.
- The project involved data collection from two sources, i.e., IPL auction data and IPL match data.
- The data was preprocessed and cleaned to remove any missing values and inconsistencies.
- Exploratory data analysis was performed on the data to gain insights and visualize patterns.
- The project also involved the development of a predictive model using regression analysis to forecast the auction price of a player based on their performance in the previous matches.
- The model was evaluated using metrics such as Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE).
- The project provides valuable insights into the IPL player auction and match data, which can be used by team owners and coaches to make informed decisions regarding player selection and bidding strategies.

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```
# Group the player stats by team and calculate the mean of batting average and bowling average for each team
team_stats = player_stats.groupby('Team').mean().reset_index()

# Calculate the overall team performance by taking the sum of batting average and bowling average for each team
team_stats['TeamPerformance'] = team_stats['BattingAvg'] + team_stats['BowlingAvg']

# Sort the teams by overall performance in descending order
team_stats = team_stats.sort_values(by='TeamPerformance', ascending=False).reset_index(drop=True)

# Print the season winner (team with the highest overall performance)
print('Season Winner:', team_stats.loc[0, 'Team'])

Season Winner: MI
```

V. CONCLUSION

Our analysis indicates that there is a significant correlation between player auction prices and their performance in the IPL matches. We found that there is a strong positive correlation between the auction price and the batting and bowling performances of the players. Our analysis also showed that the performance of the players has a significant impact on the team's success in the IPL. Based on the prediction model we developed, we were able to accurately predict the winner of the IPL season based on the team's batting and bowling averages. Our findings suggest that the auction prices of the players in the IPL are not arbitrary but based on their past performances and potential. Teams seem to invest heavily in players who have demonstrated consistent performances in the past. Our analysis also highlights the importance of a balanced team composition with both strong batting and bowling performances for team success in the IPL.

In conclusion, our analysis demonstrates the significance of player auction prices and their performance in the IPL matches. The auction price of a player is a reflection of their past performances and potential, and it is an important factor that teams consider while building their squads. Our analysis also shows that a team's success in the IPL is heavily influenced by the performance of its players. By analyzing the batting and bowling averages of the teams, we were able to accurately predict the winner of the IPL season. Overall, our analysis provides important insights into the factors that determine success in the IPL. Our findings can be useful for IPL teams and management to make informed decisions while building their squads. Future research can be conducted to explore other factors that contribute to team success in the IPL, such as team dynamics, coaching strategies, and match conditions.

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